

ONTARIO DEPARTMENT OF MINERAL MINERAL AGGREGATES A VITAL RESOURCE



Ministry of
Natural
Resources

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Mineral Aggregates in Ontario

Sand, gravel and crushed stone play a vital role in our daily life, but unless the valuable natural resource is managed wisely, the lifestyle of our society as we know it could be altered substantially.

Mineral aggregates, as they are called, provide the bulk of the raw materials essential to the construction industry for houses, schools, office buildings, expressways, sewer pipes and culverts. Many industrial applications such as fluxes for metal smelting and sand for newspaper also rely on the mineral aggregate industry.

These naturally-occurring, non-renewable mineral aggregates are composed of mineral or rock particles derived from crushing rock of the earth's crust (bedrock) or from sorting unconsolidated deposits overlying bedrock.

Although there are some alternative sources or substitutes for mineral aggregates, such as underground mining of limestone, natural aggregate transported long distances, wastes and by-products, each of these alternatives or substitutes presents its own problems. Underground mining requires high capital expenditure. Transportation of aggregates is expensive. And the quality of waste material available for use as aggregate is generally low. However, all of these options are being studied by the Ontario Government to ensure a future supply of mineral aggregates in one form or another.

Specific information on any individual pit or quarry is available from the following District Offices of the Ministry of Natural Resources.

Sudbury
P.O. Box 3500, Station A, Sudbury, Ontario P3A 4S2, (705) 522-7823
Sault Ste. Marie
75 Elgin Street, Sault Ste. Marie, Ontario P6A 2Y4, (705) 254-6884
Ottawa
Ramsayville, Ontario K0A 2Y0, (613) 822-2525
Napanee
Napanee, Ontario K0K 2R0, (613) 354-2173
Huron
Midhurst, Ontario L0L 1X0, (705) 728-2900
Niagara
37 Pelham St., Box 1070, Fonthill, Ontario L0S 1E0, (416) 892-2656
Maple
Maple, Ontario L0J 1E0, (416) 832-2261
Cambridge
Beaverdale Rd., Cambridge, Ontario N3C 2V3, (519) 658-9356
Lindsay
322 Kent St. W., Lindsay, Ontario K9V 2Z9, (705) 324-6121
Aylmer
353 Talbot St. W., Aylmer West, Ontario N5H 1S8, (519) 773-9241
Chatham
Box 1158, Chatham, Ontario N7M 5L8, (519) 354-7340
Simcoe
645 Norfolk St. N., Simcoe, Ontario N3Y 3R2, (519) 426-7650
Owen Sound
511 9th Avenue East, Owen Sound, Ontario N4K 3E4, (519) 376-3880

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ONTARIO MINERAL AGGREGATES A VITAL RESOURCE

Geology

Bedrock aggregates are quarried, crushed, and sized to specifications as shown in Figure 1. The suitability of bedrock as aggregate depends upon its physical properties and its capability to withstand stresses when used as a construction material.

Granular aggregates are obtained from unconsolidated deposits as shown in Figure 2. The erosional products created prior to glaciation, mixed with the additional deposits resulting from glacial episodes over the last two million years, form the source material for Ontario's granular aggregates. Glacial materials sorted and distributed outwash deposits, glacial lakes formed beaches and allowed deltaic deposits to occur, and debris piled up in contact with glacial ice to form eskers, kames and moraines. Several of Ontario's best gravel deposits are located in outwash deposits occurring as sheet deposits or as terraced valleyfills (valley trains).



Uses

Currently, Ontarians use approximately 12.7 tonnes (14 tons) per capita of aggregate per year. More than 90 per cent of the total output of the mineral aggregate industry is used in construction. Of this, over 50 per cent is used in road and other transportation facilities. The total consumption of mineral aggregates in Ontario is 100 million tonnes (110 million tons) per year, with the municipalities using 29 million tonnes (32 million tons) for road work. Ontario's production of all structural materials in 1976 was valued at slightly more than \$380 million.

In the Central Ontario region alone, Metropolitan Toronto and the surrounding area consume 27 million tonnes (30 million tons) of mineral aggregate per year. If each ton of sand, gravel or stone had to be trucked one extra mile, this would have necessitated about 8.75 million extra kilometres (5.5 million extra miles) of truck travel, at about 5.5 million extra litres (1.25 million extra gallons) of fuel, adding about \$8 million to the cost of the aggregate. This would be costly to the public in terms of increased road traffic but also in energy, taxes, increased building costs and direct cost of materials unless we learn enough about the situation to help solve the problems involved.

While mineral aggregates are becoming more costly to supply, they are also becoming less accessible in the areas where they are the most needed. Part of the problem lies in the fact that more and more large urban developments are being built on the land where these mineral aggregates lie. The underlying aggregate deposit then becomes unavailable for use and alternate deposits have to be found. Alternatives, as previously explained, will be expensive — mainly because of increased costs of transportation.



Production

Not all sand, gravel and stone is suitable for mineral aggregate. The best sources of gravel are those laid down by glacial action. The normal method of extraction in Southern Ontario is using surface mining, taking the following steps for production:

- Clearing:** the removal and disposal of trees, shrubs and other vegetation.
- Stripping:** the removal and stockpiling of topsoil for later use.
- Excavation:** the removal of the deposit.
- Stockpiling:** materials are stockpiled to meet surges in demand.
- Processing:** operations such as screening, crushing, washing and de-watering.
- Transporting:** transporting materials around the plant site.
- Rehabilitation:** the shaping of the excavated area, replacement of soil and fill and the planting of vegetation, all to suit the intended after-use of the site.

A more detailed diagram of operations is illustrated in Figures 1 and 2.

Legislation

In recognition of the vital role that the aggregate industry plays in our economy, the Ontario Government has developed a provincial policy to manage the resources wisely and to regulate the aggregate industry.

The first step was the passing of The Niagara Escarpment Protection Act in 1970. This was introduced as interim legislation to protect the Niagara Escarpment from extraction, pending passage of province-wide legislation.

The Pits and Quarries Control Act was passed in 1971. The intent of the Act was to provide rules and regulations for designated townships and areas of Ontario in order to accelerate rehabilitation of the

Legislation (continued)

land and minimize the environmental impact of pit and quarry operations. As of August, 1977, 278 Ontario townships were designated, embracing almost the whole of Southern Ontario and parts of Northern Ontario. The essential purpose of the Act is to stimulate wise use of the resource in meeting the aggregate requirements of the Province.

Responsibility for the control of pits and quarries in Ontario rests with the Ministry of Natural Resources. This Ministry places authority with its Division of Mines, through four of the Ministry's regional offices. The regional offices employ mineral resources supervisors for administrative guidance, and assign pit and quarry inspectors to most district offices of the Ministry. A list of district offices can be found overleaf. Together, this staff must communicate with municipalities and other government levels to ensure that the operations of aggregate producers are acceptable to the municipalities in which they are located. A good understanding is reached most often when producers adhere to standards governing noise level, dust, truck traffic and progressive rehabilitation of the site following extraction.

Rehabilitation

Progressive rehabilitation simply involves returning pit areas to stable and aesthetic landforms, with a permanent vegetation cover. This should be done on a continuous basis as material is being extracted.

Unfortunately, past rehabilitation efforts have not always been adequate. There have been, however, some notable examples of pit and quarry rehabilitation in Ontario, among them the Royal Botanical Gardens, Hamilton; the St. Mary's Quarry, St. Mary's, and East Park Golf Course, London. There are also many sites being progressively rehabilitated across the Province.

It has been demonstrated in Europe and North America that rehabilitation can take the form of sites for housing developments, parks and recreational areas, farmland, wildlife areas, golf courses, and waste disposal.

A number of Ontario operators are experimenting with different forms of rehabilitation, particularly to agriculture and pasture. Recently, an Ontario aggregate producer received a national award for its rehabilitation achievements on part of the Niagara Escarpment.



Ontario Mineral Aggregate Working Party

In December, 1975, the Ontario Government appointed the Ontario Mineral Aggregate Working Party to investigate and recommend a more acceptable Mineral Aggregate Resource Management Policy for the Province of Ontario. The Working Party was made up of 13 representatives from municipal councils and staff, various government ministries, the aggregate industry and an environmental organization. Their conclusions, drawn from public meetings across the Province and lengthy debates among themselves, have led to the publication of a report entitled, A Policy for Mineral Aggregate Resource Management in Ontario. The key recommendations of the report are:

1. There should be more input by the municipalities and the local people in decision-making, determining acceptable operating conditions and rehabilitation plans.
2. Techniques used for estimating future demand of aggregates be vastly improved.
3. Aggregate deposits should be identified and protected from urban development which may preclude future extraction.
4. The process for obtaining a pit or quarry licence be more simplified.
5. Greater assurances for rehabilitation be established through a special fund created from a licence fee and more specific provisions in the site plan applications.
6. Local municipalities receive financial assistance for the real costs incurred as a result of aggregate extraction, such as road maintenance stemming from pit and quarry operations.
7. A new procedure be adopted for the issuance of permits for wide area pits and quarries.

The Ministry of Natural Resources is currently working on methods of implementing the recommendations of the Working Party prior to new legislation being passed.

Other Studies

The Province has also commissioned studies at two Ontario universities in an effort to stimulate academic involvement in aggregate policies. Studies taking place through the University of Waterloo and the University of Guelph will aid the Province in its plans for developing a policy for rehabilitation of all existing abandoned pits and quarries.

In addition, the Province, through the Ministry of Natural Resources, is currently involved in two Northern Ontario studies to evaluate the engineering terrain and estimate potential mineral aggregate extraction areas. The terrain study covers an area of 391,000 km² (151,000

Other Studies (continued)

sq. mi.). Detailed mineral aggregate studies will soon be under way for the Sudbury and Thunder Bay areas. The Ministry is also preparing a detailed aggregate inventory for over 200 townships in Southern Ontario.

Overall, it is hoped that through all of these efforts, the people of the Province of Ontario will become more aware of the role that aggregates play in their lives. The wise management of such a non-renewable resource is essential. Only through efforts by government, industry and the public, to achieve understanding of the aggregate commodity, will aggregates continue to provide the facilities — the houses, roads and schools — we have come to depend on as an integral part of our lifestyle.

Several reports and other publications on mineral aggregates are available from the Ministry of Natural Resources free or at nominal cost. Among them are:

1. A Guide to Site Development and Rehabilitation of Pits and Quarries, I.M.R. 33 (1970) — suggests possible methods for site planning and site improvements during operations (\$1.25).
2. Vegetation for the Rehabilitation of Pits and Quarries — the selection of vegetation species best suited to supplement rehabilitation work (free).
3. A Policy for Mineral Aggregate Resource Management in Ontario (1977) — the report of the Working Party recommending a more effective and broadly acceptable Mineral Aggregate Resource Management Policy for the Province of Ontario (\$3.00).
4. Mineral Aggregate Study and Geological Inventory of Part of the Eastern Ontario Region, by Proctor and Redfern Limited and Garner, Lee Associates Limited (\$25.00; Summary Report (\$1.00).
5. Mineral Aggregate Study and Geological Inventory of the Central Ontario Region, by Proctor and Redfern Limited (\$25.00; Summary Report (\$1.00).
6. Mineral Aggregate Study and Geological Inventory of the Southwestern Ontario Region, by Proctor and Redfern Limited and Garner, Lee Associates Limited (\$25.00; Summary Report (\$1.00).

Ministry publications may be obtained from:

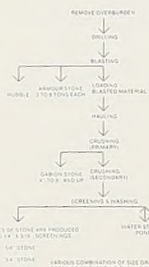
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Please make cheque payable to Treasurer of Ontario.

Extraction Methods

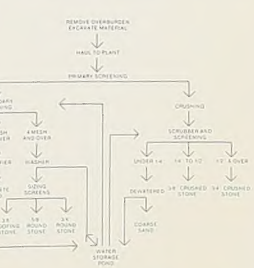
Flow Diagram for a Crushed Stone Operation

Figure 1



Flow Diagram for a Sand & Gravel Operation

Figure 2



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Minister
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